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## THE MODES OF ACTION OF EMETICS.

BY



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## THE MODES OF ACTION OF EMETICS.\*

By W. C. CALDWELL, M.D.,

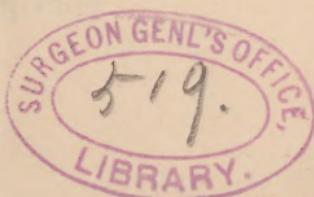
Professor of Materia Medica and Director of Pharmacological Laboratory, COLLEGE PHYSICIANS AND SURGEONS, Chicago.

**T**HE stomach is not only capable of emptying itself downward through the duodenum, but also upward through the cœsophagus. Drugs which produce this latter action on the stomach, are called emetics. The act of emesis or vomiting consists of the following five co-ordinated movements :

- 1) The cardia relaxes.
- 2) The pylorus contracts.
- 3) The muscles of the body of the stomach contract. The gastric muscles take a very active part, as can be easily seen by opening abdomen and then observing the action of an emetic. The contraction begins at the pylorus, and the wave passes toward the cardia, the stomach assuming a globular shape and becoming smaller from contraction of the muscles.
- 4) The diaphragm contracts, and
- 5) The abdominal muscles contract, so that the stomach is compressed between these and the diaphragm, which helps to squeeze the contents out.

In order for these actions to empty the stomach, they must all act at the right time, otherwise it would be an ineffectual attempt at vomiting, hence all these movements are presided over and excited at the right time by a complicated nervous mechanism. Before trying to tell you the various ways

\* Lecture on Emetics and Anti-emetics.



drugs may act on this nervous mechanism to cause vomiting, I will have to describe at least briefly the different parts of it and their functions.

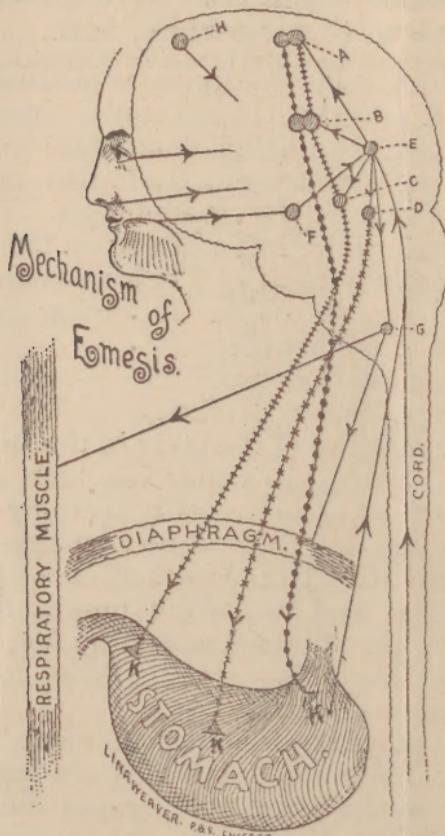


FIG. I.

#### I. THE NERVOUS MECHANISM OF VOMITING.

As shown in Figure 1, this consists of a number of centers with which are connected efferent and afferent nerves.

CENTERS. These are situated in the brain, medulla, and upper portion of the cord.

1) *Vomiting center*. Located in the corpora quadrigemina E, and connected with the

centers of the cardia A and B, pylorus A B, and C, stomach wall D, and certain ganglia of the respiratory center G. It is connected indirectly through other centers with afferent fibers from the stomach and other parts of the body. A subsidiary vomiting center is supposed to be located in the upper part of the spinal cord, but for simplicity it is not shown in diagram.

2) *Centers for cardia and pylorus.* In the corpus striatum is a center B, which when stimulated causes, simultaneously, the pylorus to contract and the cardia to open. In the sulcus cruciatus another similar center A exists. In the corpora quadrigemina is a center C for the contraction of the pylorus alone.

3) *Center for the stomach.* In the corpora quadrigemina is a center D for contracting the body of the stomach. It seems that the pylorus and cardia have more highly developed mechanisms presiding over them as shown by the additional centers higher up in the brain. Also the local mechanism of pylorus and cardia are more highly developed, as shown by the ganglia of AUERBACH's plexus K being much more numerous at pylorus and cardia.

4) *Center for diaphragm and abdominal muscles.* These are the ganglia of the respiratory center G which innervate the muscles.

EFFERENT NERVES. There are five sets of these passing respectively from the corresponding centers to the five sets of muscular structures. They run partly in the vagus and partly in the cord and sympathetic, but to represent them in the diagram would require too many lines. The fibers of the pylorus, cardia, and stomach wall terminate in AUERBACH's plexus.

**AFFERENT NERVES.** These are afferent fibers from the mucous membrane of the stomach running in the vagi and sympathetic to the medulla and from there connected with the vomiting center E in the corpora quadrigemina. Also other afferent nerves, including those of special sense after passing to their appropriate centers, pain, taste, smell and sight, are connected with the vomiting center.

## II. FUNCTION OF DIFFERENT PARTS OF THE MECHANISM.

The difference in the function of the vomiting center and the centers for five sets of muscles must be distinctly borne in mind. Excitation of the vomiting center produces a *sensation of nausea*, the same as excitation of the olfactory center a sensation of smell, or of the gustatory center F a sensation of taste. While excitation of the center for pylorus, cardia, stomach, diaphragm, or abdominal muscles does not produce a sensation, but contraction of a set of muscles. The function of the vomiting center is not to contract the muscles, but as can be seen in diagram I, by the lines connecting it with these centers, *to excite them all simultaneously*. The function of the vomiting center is to receive the afferent impressions and switch them on to the five centers at the same time. If only a part of these centers were excited, vomiting could not result, but simple a retching.

## III. THE WAYS THAT DRUGS CAN ACT UPON THIS MECHANISM TO PRODUCE VOMITING.

Vomiting can only be produced by stimulating the vomiting center. This center can be stimulated in only two ways, either *directly* or *reflexly*,—either by exciting the center itself or by exciting one of the

various afferent nerves. Irritation of any other portion of this mechanism will only cause the corresponding portion of the muscles to act.

1) *Reflexly*. The most common way is by irritation of the mucous membrane of the stomach, the impression being conveyed by the afferent nerves to the vomiting center which causes a simultaneous action of the centers presiding over the five sets of

muscles. The drugs which produce emesis this way are called LOCAL EMETICS, such as mustard, salt, copper sulphate, and zinc sulphate. Vomiting may also be produced reflexly by irritation of other parts of the body, besides the stomach, but it is disease rather than drugs that acts at all at these different points. As shown in Figure 2, it may be reflexly excited by irritation of the liver, kidneys, intestines, uterus, bladder, lungs, meninges, etc. As shown in Figure 3, vomiting may also be reflexly excited by impressions from the special senses. The impression of a bitter substance in the mouth is conveyed to the taste center D, producing a sensation of bitterness, and sometimes may be reflected from this center to the vomiting center A, exciting a sensation of nausea and from this it may be simultaneously

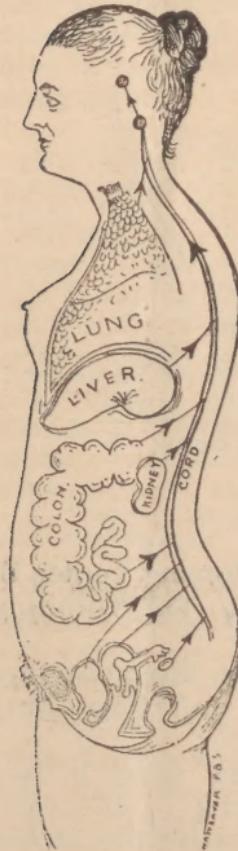


FIG. 2.

center A, exciting a sensation of nausea and from this it may be simultaneously

reflected to the centers presiding over the muscles. In the same way a disagreeable odor, or shocking sight, or even a thought of some disgusting odor, etc., may reflexly cause vomiting. The tongue depressor may reflexly excite vomiting by the irritation be-

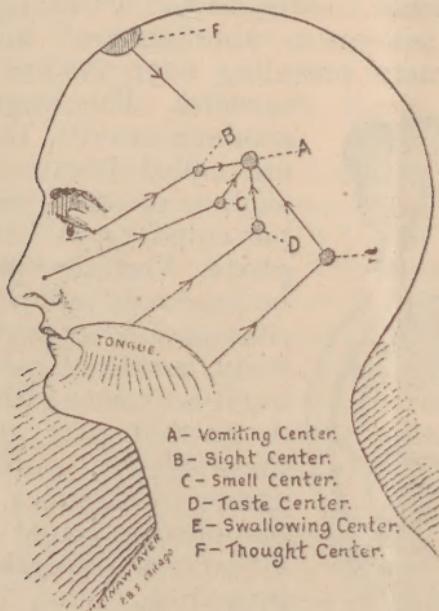


FIG. 3.

ing transmitted to the swallowing center E, and then being reflected to the vomiting center.

2) *Directly*. These drugs after entering the circulation act directly on the vomiting center. They are called:

SYSTEMIC EMETICS. To this class belong apomorphine, ipecac, squill, and tartar emetic. In numerous experiments it has been shown that after the vomiting center in the corpora quadrigemina has been destroyed, apomorphine is unable to produce vomiting. The local emetics act without

entering the circulation, hence they require only two or three minutes, while the systemic have to be absorbed and pass to the cerebrum, which requires more time. The action of the systemic continues longer and, of course, after entering the blood they act upon other organs, causing considerable constitutional disturbance, such as muscular weakness and depression of the circulation. Some emetics appear to act both ways. Zinc sulphate and copper sulphate after absorption have a slight action on the center. Also tartar emetic and ipecac have a slight reflex action.

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